CLAIMS

What is claimed is:

1. A device for the fixation of a ligament or tendon implant to an endosteal portion of a bone of a patient comprising:

a ligament attachment member comprising a grasping hook configured for grasping a free end of the ligament or tendon implant, and a shaft attached to the grasping hook, the ligament attachment member adapted to fit within a hole in said bone;

securing means for securing the ligament attachment member to the bone.

2. The device of claim 1, where the securing means is configured to attach to the shaft of the attachment member.

3. The device of claim 2, where the shaft further comprises a threaded shaft for attaching to the securing means.

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4. The device of claim 3, where the securing means comprises a retention disc with a threaded hole adapted to rotatably attach to the threaded shaft.

5. The device of claim 4, where the retention disc has a frusto-conical shape.

6. The device of claim 4, where the hole in the bone further comprises a contoured hole including a larger-diameter portion and a narrower-diameter portion and an annular ledge residing between said larger-diameter portion and said narrower-diameter portion, and wherein the retention disc can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

7. The device of claim 6, wherein the annular ledge defines a frusto-conical surface.

8. The device of claim 4, where the retention disc is comprised of a metal.

9. The device of claim 8, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-

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chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

10. The device of claim 4, where the retention disc is comprised of a plastic.

11. The device of claim 10, where the plastic is an ultra high molecular weight polyethylene.

12. The device of claim 3, where the securing means comprises a threaded nut.

13. The device of claim 12, where the hole further comprises a contoured hole including a larger diameter portion where the threaded nut can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

14. The device of claim 13, where the securing means further comprises a washer placed between the threaded nut and the bone.

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15. The device of claim 12, where the threaded nut is comprised of a metal.

16. The device of claim 15, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

17. The device of claim 12, where the threaded nut is comprised of a plastic.

18. The device of claim 17, where the plastic is an ultra high molecular weight polyethylene.

19. The device of claim 1, where the attachment member is comprised of a metal.

20. The device of claim 19, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

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21. The device of claim 1, where the attachment member nut is comprised of a plastic.

22. The device of claim 21, where the plastic is an ultra high molecular weight polyethylene.

23. The device of claim 1, where the grasping hook has a circular shape forming at least 60% of the arc length of a circle.

24. The device of claim 1, where the grasping hook is an asymmetrical open loop with an open portion.

25. The device of claim 1, where the grasping hook is a symmetrical open loop with a circular portion forming no greater than 50% of an arc length of a circle.

26. A device for the fixation of a ligament or tendon implant to a bone of a patient comprising:

a ligament attachment member comprising a grasping means configured for grasping a free end of the ligament or tendon implant, and a shaft attached to the grasping means, the

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ligament attachment member adapted to fit within a hole in said bone;

a securing means for securing the ligament attachment member to the bone when the shaft is inserted into the securing means, the securing means including a receiving means;

a locking means disposed on the shaft for interacting with the receiving means of the securing means in a non-threaded interference fit to thereby inhibit movement of the ligament attachment member relative to the bone in a first direction.

27. The device of claim 26, where the securing means is disposed to attach to the shaft of the ligament attachment member.

28. The device of claim 26, where the first direction is opposite the direction in which the shaft is inserted.

29. The device of claim 26, where the locking means further comprises a series of slanted ridges formed along the long axis of the shaft.

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30. The device of claim 29, where the securing means further comprises a push nut.

31. The device of claim 30, where the receiving means further comprises one or more flanges located on the push nut, surrounding a central hole, the flanges being configured to allow the slanted ridges on the shaft to pass in one direction when the shaft is inserted into the central hole, but engaging the slanted ridges in an interference fit when the shaft is moved in a second, opposing direction, to thereby permit adjustable tension in the implant.

32. The device of claim 31, where the drill hole further comprises a contoured drill hole including a larger diameter portion where the push nut can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

33. The device of claim 32, where the push nut is comprised of a metal.

34. The device of claim 33, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-

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chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

35. The device of claim 32, where the push nut is comprised of a plastic material.

36. The device of claim 35, where the plastic material is an ultra high molecular weight polyethylene.

37. The device of claim 26, where the attachment member is comprised of a metal.

38. The device of claim 37, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

39. The device of claim 38, where the attachment member is comprised of a plastic material.

40. The device of claim 39, where the plastic material is an ultra high molecular weight polyethylene.

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41. The device of claim 26, where the grasping means further comprises a grasping hook.

42. A method of attaching a ligament or tendon implant to the endosteal portion of a bone of a patient comprising the steps of:

(a) drilling a hole through the bone of the patient;

(b) attaching the implant to an anatomical structure other then the bone;

(c) inserting through the drill hole an attachment member comprising a grasping hook, configured for grasping a free end of the ligament or tendon implant and a shaft attached to said grasping hook, wherein the shaft is configured to interact with a securing means, and wherein the shaft and grasping hook adapted to fit within a drill hole in said bone;

(d) grasping the free end of the implant with the grasping hook;

(e) drawing the implant into the drill hole;

(f) securing the shaft to the securing means, such that the implant is retained within the drill hole.

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43. The method of claim 42, where the securing means is configured to attach to the shaft of the attachment member.

44. The method of claim 43, where the shaft further comprises a threaded shaft for attaching to the securing means.

45. The method of claim 44, where the securing means comprises a retention disc with a threaded hole adapted to rotatably attach to the threaded shaft.

46. The method of claim 45, where the retention disc has a frusto-conical shape.

47. The method of claim 45, where the step of drilling a hole in the bone further comprises drilling a contoured drill hole including a larger diameter portion where the retention disc can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

48. The method of claim 45, where the retention disc is comprised of a metal.

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49. The method of claim 48, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

50. The method of claim 44, where the retention disc is comprised of a plastic.

51. The method of claim 50, where the plastic is an ultra high molecular weight polyethylene.

52. The method of claim 45, further comprising the step of attaching a tension measuring means to the implant.

53. The method of claim 52, further comprising the step of adjusting the attachment of the retention disc until the implant reaches a predetermined tension.

54. The method of claim 44, where the securing means comprises a threaded nut.

55. The method of claim 54, where the step of drilling a hole in the bone further comprises drilling a contoured

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drill hole including a larger diameter portion where the threaded nut can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

56. The method of claim 55, where the securing means further comprises a washer placed between the threaded nut and the bone.

57. The method of claim 56, where the threaded nut is comprised of a metal.

58. The method of claim 57, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

59. The method of claim 54, where the threaded nut is comprised of a plastic.

60. The method of claim 59, where the plastic is an ultra high molecular weight polyethylene.

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61. The method of claim 42, where the attachment member is comprised of a metal.

62. The method of claim 61, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

63. The method of claim 42, where the attachment member nut is comprised of a plastic.

64. The method of claim 63, where the plastic is an ultra high molecular weight polyethylene.

65. The method of claim 53, further comprising the step of attaching a tension measuring means to the implant.

66. The method of claim 65, further comprising the step of adjusting the attachment of the retention disc until the implant reaches a predetermined tension.

67. The method of claim 42, where the implant comprises a bone patellar tendon bone implant.

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68. The method of claim 42, where the implant comprises an Achilles tendon bone implant.

69. The method of claim 42, where the implant comprises a central quad tendon implant.

70. The method of claim 42, where the implant comprises a hamstring tendon implant.

71. The method of claim 42, where the implant comprises an artificial ligament material.

72. A method of attaching a ligament or tendon implant to the endosteal portion of a bone of a patient comprising the steps of:

(a) drilling a hole through the bone of the patient;

(b) attaching the implant to an anatomical structure other then the bone;

(c) inserting through the drill hole an attachment member comprising a grasping means for grasping the ligament or tendon implant and a shaft attached to said grasping means, wherein the shaft and grasping means are adapted to fit within

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the hole in said bone, the attachment member further comprising a locking means disposed on the shaft;

(d) grasping the free end of the implant with the grasping means;

(e) drawing the implant into the drill hole;

(f) inserting the shaft into a securing means having a receiving means for interacting with the locking means in a non-threaded interference fit to thereby inhibit movement of said attachment member relative to the bone in a first direction; and

(g) inserting the shaft further into the securing means until the implant is subjected to an increased tension, and locking the shaft with the locking means to thereby maintain said increased tension.

73. The method of claim 72, where the securing means is disposed to attach to the shaft of the ligament attachment member.

74. The method of claim 72, where the first direction is opposite the direction in which the shaft is inserted.

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75. The method of claim 72, where the locking means further comprises a series of slanted ridges formed along the long axis of the shaft.

76. The method of claim 75, where the securing means further comprises a push nut.

77. The method of claim 76, where the receiving means further comprises one or more flanges located on the push nut, surrounding a central hole, the flanges configured to allow the slanted ridges on the shaft to pass in one direction when the shaft is inserted into the central hole, but engaging the slanted ridges in an interference fit when the shaft is moved in an opposite direction.

78. The method of claim 77, where the step of drilling a hole in the bone further comprises drilling a contoured hole including a larger diameter portion where the push nut can be secured against the bone with the entire device remaining inside the endosteal portion of said bone.

79. The method of claim 78, where the push nut is comprised of a metal.

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80. The method of claim 79, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

81. The method of claim 77, where the push nut is comprised of a plastic material.

82. The method of claim 81, where the plastic material is an ultra high molecular weight polyethylene.

83. The method of claim 72, where the attachment member is comprised of a metal.

84. The method of claim 83, where the metal is selected from the group comprising: titanium, stainless steel, cobalt-chromium-molybdenum alloy, titanium-aluminum vanadium alloy, and other alloys thereof.

85. The method of claim 84, where the attachment member is comprised of a plastic material.

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86. The method of claim 85, where the plastic material is an ultra high molecular weight polyethylene.

87. The method of claim 72, where the grasping means further comprises a grasping hook.

88. The method of claim 72, further comprising the step of attaching a tension measuring means to the implant.

89. The method of claim 72, where the implant comprises a bone patellar tendon bone implant.

90. The method of claim 72, where the implant comprises an Achilles tendon bone implant.

91. The method of claim 72, where the implant comprises a central quad tendon implant.

92. The method of claim 72, where the implant comprises a hamstring tendon implant.

93. The method of claim 72, where the implant comprises an artificial ligament material.

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94. A device for the fixation of a ligament or tendon implant to a bone of a patient comprising:

an ultra high molecular weight polyethylene ligament attachment member comprising a a grasping hook configured for grasping a free end of the ligament or tendon implant, a shaft attached to the grasping hook, and a series of slanted ridges formed along the long axis of the shaft, the ligament attachment member adapted to fit within a contoured drill hole in said bone;

an ultra high molecular weight polyethylene push nut for securing the ligament attachment member to the bone, disposed to attach to the shaft of the ligament attachment member when the shaft is inserted into the push nut, the push nut further comprising one or more flanges surrounding a central hole, the flanges configured to allow slanted ridges on the shaft to pass in one direction when the shaft is inserted into the central hole, but engaging the slanted ridges in an interference fit when the shaft is moved in an opposite direction to thereby inhibit movement of said ligament attachment member relative to the bone in a direction opposite the direction in which the shaft is inserted as the push nut is secured against an annular ledge of the contoured drill hole in the bone, where a larger-diameter portion of the

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contoured drill hole is connected to a narrower-diameter portion of the contoured drill hole, and the entire device remains inside the endosteal portion of said bone.

95. A device for the fixation of a ligament or tendon implant to a bone of a patient comprising:

a flexible grasping means, configured for grasping a free end of the ligament or tendon implant;

tensioning means attached to the flexible grasping means for adjusting the tension of the implant when the grasping means is attached to the implant; and

means for securing the tensioning means to the bone when the implant is adjusted to a predetermined tension.

96. The device of claim 95, where the flexible grasping means comprises a flexible continuous loop attached to the tensioning means.

97. The device of claim 96, where the tensioning means further comprises a rotatable tensioning disc.

98. The device of 97, where the flexible continuous loop passes through holes in the rotatable tensioning disc.

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99. The device of claim 96, where the means for securing the implant comprises a screw that is attached to the bone through the rotatable tensioning disc.

100. The device of claim 96, where the tensioning means further comprises an eyebolt attached to a rotatable tensioning disc.

101. The device of claim 100, where the flexible continuous loop is attached to the eyebolt.

102. The device of claim 101, where the means for securing the implant comprises a screw that is attached to the bone through the rotatable tensioning disc.

103. The device of claim 95, where the flexible grasping means comprises a flexible strand that may be attached to the tensioning means.

104. The device of claim 103, where the tensioning means further comprises a tensioning disc and a cable collector.

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105. The device of claim 104, where the cable collector may be crimped on the cable to hold the implant at a desired tension.

106. A method of attaching a ligament or tendon implant to the endosteal portion of a bone comprising the steps of:

(a) drilling a hole through the bone of a patient;

(b) attaching the implant to another anatomical structure;

(c) inserting through the hole an attachment member comprising

a flexible grasping means, configured for grasping a free end of the ligament or tendon implant;

a tensioning means attached to the flexible grasping means, the tension means configured to adjust the tension of the implant when the grasping means is attached to the implant and disposed in a hole located inside said bone;

(d) grasping the free end of the implant with the flexible grasping means;

(e) pulling the implant into the hole;

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(f) adjusting the tension of the implant to a predetermined tension by activating the tensioning means; and

(g) securing the tensioning means to the bone.

107. The method of claim 106, where the flexible grasping means comprises a flexible continuous loop attached to the tensioning means.

108. The method of claim 107, where the tensioning means further comprises a rotatable tensioning disc.

109. The method of 108, where the flexible continuous loop passes through holes in the rotatable tensioning disc.

110. The method of claim 108, where the tensioning means further comprises an eyebolt attached to a rotatable tensioning disc.

111. The method of claim 110, where the flexible continuous loop is attached to the eyebolt.

112. The method of claim 108, where the step of adjusting the tension on the implant further comprises activating the

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tensioning means by rotating the rotatable tensioning disc to shorten the flexible grasping means.

113. The method of claim 112, where the rotatable tensioning disc is held against an annular ledge located in the drill hole of the bone.

114. The method of claim 113, where the means for securing the implant comprises a screw that is attached to the bone through the rotatable tensioning disc.

115. The method of claim 114, where the step of securing the tensioning means to the bone further comprises inserting a screw into the bone through the rotatable tensioning disc.

116. The method of claim 115, where the screw is inserted into the bone through a screw hole in the rotatable tensioning disc.

117. The method of claim 106, where the flexible grasping means comprises a flexible strand that may be attached to the tensioning means.

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118. The method of claim 117, where the tensioning means further comprises a tensioning disc and a cable collector.

119. The method of claim 118, where the step of adjusting the tension of the implant further comprises drawing the cable through the retaining disc and cable collector until the implant reaches a desired tension.

120. The method of claim 118, where the tensioning disc is held against an annular ledge located in the drill hole of the bone.

121. The method of claim 120, where the step of securing the tensioning means to the bone comprises crimping the cable collector to hold the implant at a desired tension.

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